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ABSTRACT

Analyzed was the performance of 36 third grade children with various reading and articulation skills in blending selected syllables across three modes of presentation. Ss were divided into three groups: one with normal reading and speech skills, one with below grade-level reading skills and normal speech skills, and one with grade-level reading skills but exhibiting an articulation problem characterized by one or more defective speech sounds. Each S received a list of 81 stimuli divided into three modes of presentation (auditory, visual, and auditory-visual) within each of three mode types--vowel-consonant (VW), consonant-vowel-consonant (CVC), and consonant vowel-consonant (CV-C). CVCs were all familiar words while VCs were either real or nonsense words. Results indicated a significant effect for mode of presentation and syllable type, with the below grade-level reading group yielding the poorest performance in terms of correct responses in all modes and on all syllable types. The group with defective speech sounds usually produced the highest number of correct responses in all modes and on all syllable types. CV-C appeared to be the easiest syllable type to blend in all groups while CVC was the hardest. (Author/SBH)

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AN ANALYSIS OF SOUND BLENDING SKILLS

IN READING AND ARTICULATION

IMPAIRED CHILDREN

BY

RUTH SMITH MCKENNEY, B.S.

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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EDUCATION

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A Thesis submitted to the Graduate School
in partial fulfillment of the requirements
for the Degree
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Major Subject: Speech

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Doctor James C. Moore, Chairman

This study analyzed the performance of 36 third grade children with various reading and articulation skills in blending selected syllables across 3 modes of presentation. The subjects were divided into 3 groups of 12 each--one group with normal reading and speech skills; one group with below grade-level reading skills and normal speech skills; and one group with grade-level reading skills

but exhibiting an articulation problem characterized by one or more defective speech sounds. Each subject received a list of 81 stimuli divided into 3 modes of presentation--auditory, visual, and auditory-visual--and within each mode 3 types--vowel-consonant (VC), consonant-vowel-consonant (CVC), and consonant vowel-consonant (CV-C). In addition, three sequences of mode of presentation were used with four subjects from each disorder group receiving one sequence. CVCs were all familiar words while VCs were either real or nonsense words. In all modes all phonemes of the syllables were presented at a stimulus onset asynchrony (SOA) time of 750 msec. and each subject responded by speaking the syllable which had been presented in segments. Results indicated a significant effect for mode of presentation and syllable type with the below grade-level reading group yielding the poorest performance in terms of correct responses in all modes and on all syllable types. The group with one or more defective speech sounds produced the highest number of correct responses in all modes and on all syllable types with these exceptions: In the auditory mode the performance of the articulation group equalled that of the normal group, and on the CV-C syllable type the articulation group ranked slightly below the normal group. Within groups the auditory-visual mode produced the highest percentage of correct responses, while the auditory mode produced the least. In considering syllable type, CV-C appeared to be easiest to blend in all groups while C-V-C

was the hardest. Order of presentation did not have a significant effect upon correct productions.

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Introduction and Review of The Literature

It has been conservatively estimated that five to ten percent of the school population has reading problems of a nature severe enough to require special attention (Bateman, 1965). Although educators and researchers have long emphasized that there is no single cause of poor reading, several studies in recent months have pointed to the relationship of various auditory and speech skills to reading achievement. The fact that listening, speaking, and reading are significantly related is undeniable while the exact nature of that relationship is still far from determined.

Among auditory skills related to reading, auditory integration or blending has perhaps been the most elusive. Auditory blending involves the ability to reproduce a word by synthesizing its component sounds. The importance of auditory blending to reading achievement has been adequately expressed by Tansley (1967) in his statement, "The ability to remember sounds in sequence and to blend them smoothly and rhythmically into words is so fundamental to successful progress in developmental reading that teachers must insure that the skill is thoroughly acquired." Yet although many investigators have noted the importance of auditory abilities in learning to read, there have been few empirical studies in this area, and even fewer relating blending ability to success in reading.

Another area which prior to 1951 was virtually ignored by communication and reading experts is that of articulation ability

and reading achievement. Although in recent years more research has been done concerning articulatory competency, reading readiness, and the effect of speech training on reading success, evidence has yet to be produced drawing direct connections between any of these areas.

In the past, research concerning the incidence of speech defects among retarded readers has been of particular interest on the assumption that if speech defects and reading achievement are truly related, then retarded readers should have a high incidence of speech abnormalities. This has been reasonably substantiated by Monroe (1932) who found 27% of her reading defectives to have articulatory defects as compared to 8% in her non-defective readers. Later research by Bennett (1938), Jackson (1944), and Robinson (1946) reached similar conclusions. Bond (1935), in a widely quoted study of auditory and speech characteristics of poor readers, compared 64 poor readers with 64 good readers in grades two and three. No significant differences were shown in his data between good and poor silent readers but when oral reading ability was taken into account a significant difference in the incidence of speech defects occurred. Of those children who were retarded in oral reading but were good silent readers, 35% had speech defects, while the children who were retarded in silent reading but were good oral readers had no speech defects. Moss (1938) reached similar conclusions in a study of 983 second grade pupils when he determined that the average child with a speech defect

required 8.7 seconds longer to read a given selection, and that he made 1.8 more errors to a given page than did the average child with normal speech.

The conclusions of the preceding studies leads one to believe that speech and reading defects are to a substantial degree associated, particularly where oral reading is involved. Yet the mere presence of speech defects in retarded readers may not justify the conclusion that speech is a causal factor. For if indeed poor speech is a factor in poor reading performance, then removal of the speech defect through remedial procedures should yield improvement in the ability to read. Therefore, the effect of speech therapy and speech improvement upon reading performance has been the concern of several studies in recent years.

One of the few early studies in the area of speech training and its effect on reading achievement was done by Jones in 1951. Using 61 pairs of third grade pupils, matched individually for chronological age, mental age, and silent reading achievement, the experimenter investigated the effect of speech improvement upon silent reading ability. Jones found that the experimental subjects improved significantly in silent reading achievement compared with their matched counterparts who remained in their regular classroom and did not receive this treatment. On the other hand, Wilson (1954) reported that speech improvement at the kindergarten level resulted in a significant reduction in articulation errors but was not effective in raising reading

readiness scores. Following this it was not until 1961 that Sommers and others reported additional experimental information concerning the effects of speech corrective procedures on the reading achievement of school children. Specifically, classes of first grade children were randomly sampled to receive speech improvement or speech therapy for nine months while a similar group received speech therapy for three months. As in previous studies, speech improvement was found to affect reading skills in a significant way. Reading comprehension scores for children with normal articulation were not significantly changed by speech corrective procedures except in a matched group of 25 children with severe articulation problems. Sonenberg and Glass (1965) in a similar study of matched pairs, compared children who received only reading therapy to those who received both reading and speech therapy. Somewhat contrary to the findings of Sommers and others (1961), speech therapy given in addition to reading therapy to remedial readers with functional speech defects tended to improve reading skills beyond the improvement shown by remedial readers with functional speech problems who received only reading therapy.

The inconsistency of studies such as these lead investigators to search for related factors associated with speech difficulties that might affect reading. These were what Artley (1948) termed concomitants of the speech defect, such as embarrassment, shyness, or self-consciousness. Weaver, Furbee, and Everhart (1960) expressed these concomitants in the following causal relationships: (a) bad speech habits may generalize to silent reading; (b) the

reader may concentrate on his concern about his speech and neglect meaning; (c) speech defects may upset the rate and phrasing of reading; (d) speech defects may result in errors of pronunciation and consequent misunderstanding of words; and (e) speech defects may cause dislike for reading and result in less practice than normal speakers get.

Yet further examination of these concomitants suggested that when different reading and speaking abilities appear together, it is not a causal relationship but the result of both arising out of a common background, or the result of a certain condition affecting both reading and speaking in a similar way. Factors which have been considered in this light are intelligence, auditory acuity, auditory discrimination, and auditory memory span. Recently an investigation by Mange (1966) has further added phonetic word synthesis to this list. Using a group of 35 children with functional misarticulation of /r/ along with various other phonemes and a group of 35 normal speaking children, Mange tested their ability to make meaningful interpretation of sequences of sounds presented orally. Scoring of the test consisted of a count of the number of words accurately recognized. In comparisons of mean scores between groups there was a significant, but low, partial correlation between phonetic word-synthesis ability and the number of articulation errors. There were no significant relationships between other auditory abilities tested and number of articulation errors.

Hence the ability to combine phonemes presented orally into a meaningful word is not only related to reading ability but to some extent articulation ability. In the past the ability to blend sounds has for the most part been considered in regard to reading achievement. For this reason attention will now be directed to past and present research concerning this relationship.

Perhaps the first attempt to draw a direct connection between the ability to combine sounds orally and reading achievement was made by Monroe in 1932. Using 15 words and 415 subjects, the examiner spoke the sounds of each word in sequence pausing between each sound at the rate of two sounds a second. The test items ranked in difficulty from two-sound words such as "m-e," "g-o" to six-sound words such as "g-o-l-d-e-n." The score was derived from the number of words that the subject successfully combined from the sounds. Results showed that the reading defect group was significantly different from the controls in the ability to combine the isolated sounds into words. It was also noted that some of the reading-defect children had extreme difficulty with the test, and the group as a whole made a lower mean score than the controls.

Bond (1935), in his research in comparing 64 poor readers with 64 good readers in grades one and three, discovered reliable differences which favored normal readers in various auditory skills including sound blending.

In 1955 Mulder and Curtin tested the ability of 63 fourth grade pupils to synthesize the phonetic elements in words presented orally. A tape recording was made of seventy-eight one-syllable

nouns, separating each of the phonetic elements of the words by a one-second pause. In order to minimize the importance of reading, each of the pupils was provided with an answer sheet containing three pictures for each test item. The subjects were then asked to indicate the word they heard by checking their answer sheets. Scores from this experiment were then correlated with reading-achievement scores, yielding a Pearson product-moment correlation of .44 which was significant at the 1 per cent level of confidence and, therefore, indicating that a positive relation did exist between silent reading ability and the ability to synthesize phonetic elements of words presented orally.

Probably the most quoted article in recent times concerning auditory blending ability, reading achievement, and I.Q. was provided by Chall, Roswell, and Blumenthal in 1963. Using 62 Negro children in two first grade classes in New York City public schools, the authors constructed a 30 item test of auditory blending ability. The test consisted of three parts of ten items each and was administered individually. The examiner sounded the component parts of the word at about one-half second intervals, asked the child to tell the word he heard, and wrote the answer on a record blank. The test was administered in Grade 1, again at the end of Grade 2, and again in Grade 4. Results indicated auditory blending ability, whether tested in the first, second, third, or fourth grades, is positively correlated with oral and silent reading ability through the fourth grade. It also appeared to be more highly related to oral than to silent reading ability

and most highly related to achievement in word analysis skills. In conjunction with this, Alshan (1965), in a study concerning predictive measures of first grade reading achievement, ranked auditory blending as the highest predictor of first grade reading ability of five related factors.

With the establishment of a positive relationship between the ability to blend phonemes together and reading ability, researchers turned to investigating the variables that affect the blending task itself. Among these variables were the effect of rate of presentation of the stimuli (Beasley & Beasley, 1973; Shriner & Danilooff, 1970), the effect of meaning, nonsense, and word familiarity (Beasley & Beasley, 1973; Laumbach, 1968; Shriner & Danilooff, 1970), and the effect of phonological and linguistic characteristics of the stimuli (Brown, 1971; Coleman, 1970; & Laumbach, 1968). Holloway (1975) took a further look at these variables across three modes of presentation: auditory, visual, and auditory-visual combined. Using 30 children with normal reading and speech skills, she tested their ability to combine 150 consonant-vowel (CV), vowel-consonant (VC), and the consonant-vowel-consonant (CVC) syllables. In her results she found the order of presentation of stimuli to have little effect on the subjects' overall performance. On the other hand, presentation mode was found to have a significant main effect with performance being best with the combined audio-visual presentation mode and worst with the auditory mode. Syllable type was also found to have a significant main effect with two-phoneme sound segments

(CV-C, C-VC) being easier to blend than one-phoneme sound segments (C-V, V-C, C-V-C). The effect of rate of presentation did not have a significant main effect although a slight advantage for nonsense over real words was shown.

In examining the data of Holloway (1975) obvious questions immediately present themselves. First, now that certain trends concerning normal groups of children and their ability to blend syllables have been established--what about children with reading delays? How would their performance on significant variables compare to children with normal reading skills? Secondly, in considering the relationship between speaking and reading--how would children with articulation deficits compare in their ability to blend sounds? In an effort to shed some light on the relationship between reading ability, articulation ability, and performance on various blending tasks the following study was performed on 36 third grade subjects. Using equal groups of children with delayed reading skills, defective articulation ability, and normal reading and articulation skills; the ability of these children to blend sounds was studied in relation to order of presentation of stimuli, mode of presentation, and syllable type.

Method

Subjects

Subjects for this study were 36 third grade students from Hermosa Heights, University Hills, and Mesilla Park elementary schools in Las Cruces, New Mexico. Twenty-four subjects comprising the normal and reading test groups were found at Hermosa Heights, while the remaining 12 subjects for the articulation test group were found at University Hills and Mesilla Park elementary schools.

Subjects were judged to belong to the normal group if on the Comprehensive Test of Basic Skills (CTBS) they achieved a reading and language score of not more than six months below their chronological age, and were judged by their teachers to be reading at or above grade level. (Only four subjects fell below grade level in reading scores as measured by the CTBS.) The reading group was comprised of subjects who achieved both a CTBS reading score of at least one year below grade level and were confirmed by their teachers to be reading at or below that level. Language scores for the reading group ranged from two years to six months below grade level with a mean language age of 1.5 years. Subjects in the articulation group were at the time of the experiment receiving speech therapy from the school clinician and were confirmed by their teachers to be reading at or above grade level. Each subject had at least two defective speech sounds either

/s/, /r/, or /θ/ and their corresponding cognate. All subjects had normal hearing and vision as tested by school personnel.

Twenty subjects were females and 16 were males.

Materials

For the experiment a Stimulus List of 81 items was constructed from a list of 18 CVC words and 9 VC syllables (see Appendix A). Nine of the 18 CVCs were segmented into C-V-Cs while the remaining 9 were segmented into CV-Cs thus creating the three syllable types. Each mode of presentation--auditory, visual, and auditory-visual--contained these 27 stimuli with random ordering of syllable type and of each individual test item within syllable types. For this reason, the word "dug" would appear in the auditory mode as /dAg/, in the visual mode as "d-u-g," and both presentations would be subsequently combined in the auditory-visual mode.

Auditory and visual stimuli were selected within the following constraints (Holloway, 1975):

1. The consonants were clearly audible when presented on tape. Consonants excluded as being difficult to hear on tape were /f, p, t, k, θ/ (Shriner & Daniloff, 1970). Eleven consonants were used: /b, d, g, m, n, s, ʃ, l, r, tʃ, dʒ/. The corresponding graphemes (digraphs in two cases) were: "b, d, g, m, n, s, sh, l, r, ch, j."
2. Vowels corresponded to the first vowel sounds taught in a phonic or linguistic approach to reading (Chall, 1967): /ʌ, i, æ/ (/ε/ and /a/ were not used). The corresponding graphemes were "u, i, a."
3. There was a consistent one-to-one correspondence between phonemes and graphemes, and CVCs were excluded if the visual CV segment formed a word, for example, "be" in the word "bed."

4. All CVCs were listed in A Basic Vocabulary of Elementary School Children (Rinsland, 1945) as having occurred in the written work of third graders. (p. 13)

To insure equal difficulty of test items within modes of presentation the stimulus list was balanced in the following way. In all syllable types each of the three vowels (A, æ, I) appeared exactly three times. Within the VC list there appeared 4 sense and 5 nonsense syllables, and the 9 initial consonants each appeared once. Two of the four VCs which were real words were not spelled according to conventional orthography in the visual mode; /æd/ was spelled as "ad" and /It / was spelled as "ich." Balancing for the C-V-C list included each initial consonant appearing once, and with the exception of /b/ each final consonant appeared at least once. Similarly, in the CV-C words each final consonant appeared once except for /t / and /s/. All CVCs were real words.

To control for the effect of order of presentation, three stimulus lists were prepared. For each sequence the order of mode of presentation, syllable type within modes, and test items within syllable types were randomly arranged. For all stimuli the stimulus onset asynchrony or the interval between the onset of one stimulus and the onset of the next was 750 msec.

All orderings of the stimulus list were recorded by the experimenter in a sound treated room on a Scully Model 380-2, one half track audio tape recorder with an Electro-voice Model 615-A microphone. The microphone was connected to the input of a Gates Model M-615 8 A Executive audiovisual console, and the

program of the console was connected to the input of a Collins Model 26U-2 limiter amplifier. The limiter output was connected to the line input of the left channel of the Scully. Through ear-phones, the experimenter heard a tone delivered every 750 msec. and spoke the sound segments in time with the tone.

On the right channel of the stimulus tape a 1000 Hz. tone was recorded which corresponded to the initiation of the first sound segment of each test item.

In the visual mode, slides were prepared of the single letters, digraphs, and trigraphs which corresponded to the sound segments of the auditory mode.

Using a Franklin Gothic Condensed letter template, the letters were traced with India ink on white paper using a Variagraph Headwriter. Photographing of the letters was done using Kodak Panatonic X film and developed as negatives so that the projected image was a light figure on a dark ground. A standard copy stand was used with a Minolta SRT-101. In a D-76 developer, the film was two steps underexposed and overdeveloped to achieve maximum contrast.

To project the slides, three Sawyer Rotomatic slide projectors were adapted for the experiment. With locally constructed timing equipment, the exposure of the slides and the synchronization of the slides of the auditory with visual stimuli was triggered by a tone on the right channel of the stimulus tape recording.

Other equipment used to present and store data included a

TEAC Model 3300S tape deck, Realistic Nova 10 stereo headphones,
and a Superscope Model C-104 cassette recorder.

Procedures

Pretest Training

To insure that each subject possessed certain knowledge concerning the task he was to perform, a pretest training was conducted with each child. This training consisted of three basic steps:

(1) each subject was tested on his knowledge of the concept "together"; (2) each subject was trained to the particular blending task he was about to perform; and (3) each subject was tested concerning his knowledge of the graphemes used in the visual mode and their corresponding phonemes.

In the first step of the training the experimenter spoke three syllables and their segmented representations. The subject was then asked to state which one was "together." If the subject answered correctly on two of the three trials, knowledge of the concept of "together" was assumed and the experimenter then proceeded to the next item. If the subject did not answer two out of three correctly, examples were given and three new syllables were presented. If the subject again failed the task the experimenter did not attempt to teach the task but continued with the next item. Following this an example of each of the three syllable types was given using /pæt/ as the basic CVC.

The second step consisted of training the subject to the particular task he was about to perform. That is, for the auditory mode the experimenter spoke the segmented representations of the examples used in step one and the subject was asked to put the

segments together. If the auditory-visual mode appeared next, the experimenter spoke the segmented representations as the corresponding graphemes were presented. Again the subject was asked to put the segments together.

The third step tested the subject's knowledge of the graphemes used in the study and their corresponding phonemes. Each grapheme was presented individually to the subject and he was asked to say the "sound." If he was unable to do so, the correct response was practiced until he could produce three consecutive correct responses. The subject was then again shown the graphemes used in step one and asked to look at the letters, think of the sounds and put them together.

If an error was made during the training, the experimenter modeled the correct response and repeated the item.

All subjects received all modes of presentation although the sequence of presentation varied. Four subjects from each disorder group received one of the following sequences: Sequence I-visual, auditory, auditory-visual; Sequence II-auditory, auditory visual, visual; and Sequence III-auditory-visual, visual, auditory.

Testing

In the auditory mode, subjects listened to the experimenter tapes played from a TEAC Model 3300 S tape deck and Realistic Nova 10 stereo headphones. Intensity was adjusted to the comfort level of each subject. Subjects in the visual mode saw letters projected serially at the same point on a series approximated 4-6 feet in front of them. All letters were clearly visible and

the exposure time was well above thresholds for recognition (Gibson, Osser, & Pick, 1963). The letters, which were approximately two inches in height, were presented at a SOA time of 750 msec. with an exposure time slightly shorter than SOAs. In continuing the two presentations for the auditory-visual mode, the subjects listed the sounds as described for the auditory mode and saw the letters as described for the visual mode.

After each presentation the tape recorder automatically stopped, allowing the subject to respond. Each subject was allowed approximately five seconds to respond.

Analysis

As each subject proceeded through the experiment his responses were judged by the experimenter to be correct or incorrect with incorrect responses being recorded in broad phonetic transcription. In scoring the responses of the articulation group, errors which could be directly attributed to the subject's misarticulations were noted and not used in final scoring. For some measure of intra-judge reliability each subject's responses were recorded on a Superscope Model C-104 cassette recorder for comparison with live scoring. At a later time one-third of the subjects (four from each disorder group) were then re-scored. Since intra-judge reliability was found to be .99, live scores were used in the final analysis.

Results were measured in terms of percentage of correct responses within syllable type and mode of presentation. These results were then examined in terms of significant differences of

comparisons of syllable type and mode of presentation across disorders. The effect of sequence and presentation mode across syllable type were also considered. Since in examining the data these difference scores appeared to be symmetrically distributed around the median of zero, the Wilcoxon Signed Rank Test was used as the test statistic. The significance level used through the analysis was .05.

Results

The Effect of Order

The effect of order in the presentation of stimuli was found to be non-significant across all groups.

The Effect of Presentation Mode Across Syllable Type

The effect of presentation mode across syllable type was found to be non-significant.

The Effect of Syllable Type

The effect of syllable type was determined through comparisons between and within disorder groups (see Appendix B, Tables 1 and 2). Overall comparisons between disorder groups (see Figure 1) showed the reading group to produce the fewest correct responses on all syllable types while the articulation group yielded the highest number of correct responses on V-Cs and C-V-Cs, falling slightly below the normal group on the CV-C syllable type. Specifically, comparisons between the normal and reading groups showed significant differences in performance on all syllable types in favor of the normal group (V-C $P=.03$, C-V-C $p<.05$, CV-C $p<.25$). Comparisons between the normal and articulation groups showed a significant difference to the advantage of the articulation group only on the C-V-C syllable type ($p=.05$).

Within disorder groups, comparisons between V-C and CV-C syllables yielded a significant difference in the normal group only ($p<.005$). No significant differences were found in performance on V-C and C-V-C syllables across disorders. In

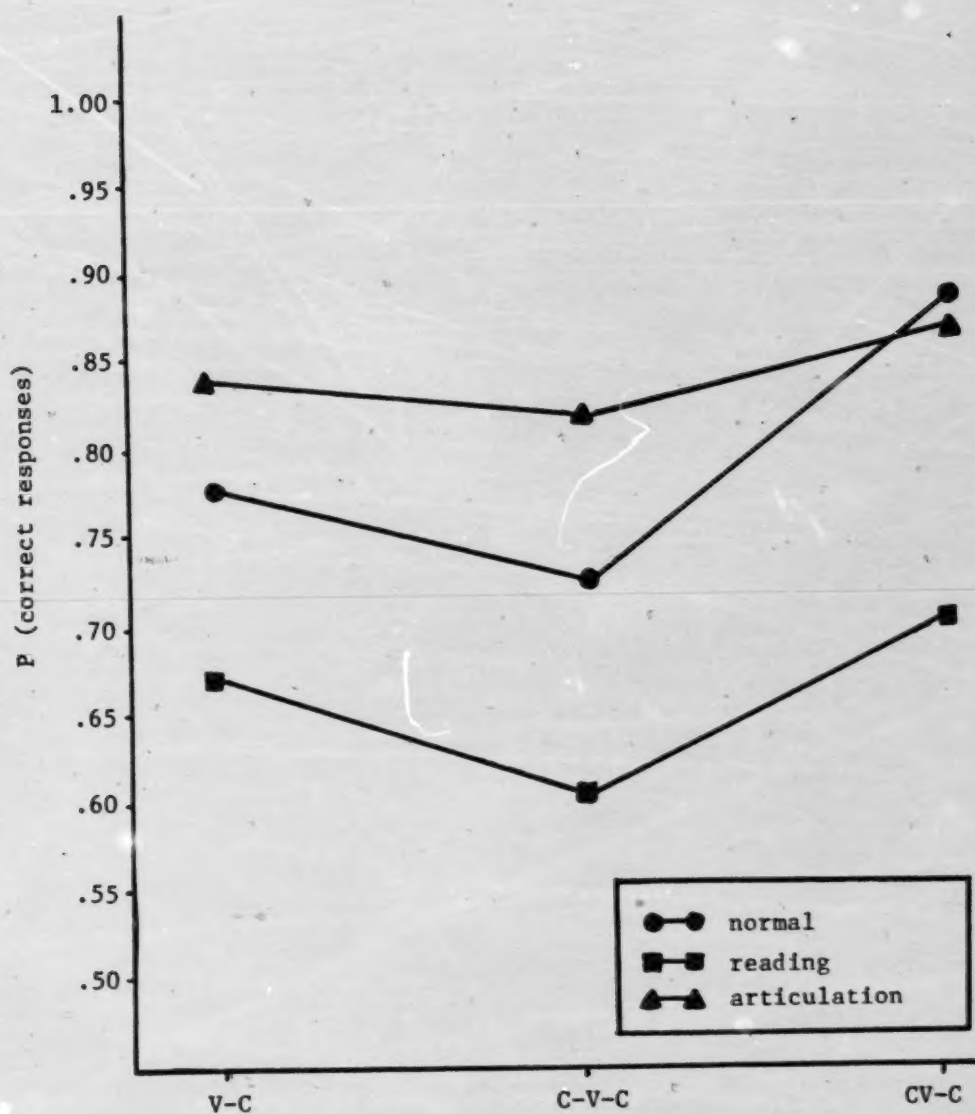


Figure 1. Effect of Syllable Type X Group

comparisons between C-V-C and CV-C, significant differences appeared in the normal and articulation groups with $p < .005$.

The Effect of Mode of Presentation

The effect of mode of presentation was determined through comparisons between and within disorder groups (see Figure 2 and Appendix B, Tables 3 and 4). In general, the below grade level reading group yielded the fewest correct responses in all modes while the articulation group produced the highest number of correct responses in the visual and auditory-visual modes, and equaled the normal group in the auditory mode. In comparisons between groups, no significant difference was obtained between modes in comparisons between the normal and articulation group. However, in comparisons between the normal and reading group, the differences between the visual mode and auditory-visual mode were significant ($p = .0061$ and $p < .0105$).

Within disorder groups, comparisons between the auditory and visual modes were found to be significant in the articulation group only ($p < .021$). Differences between the auditory and auditory-visual modes were significant in all groups with the normal group yielding a comparison score of $p = .0269$, the reading group $p = .0269$, and a difference in the articulation group of $p < .005$. In comparisons between the visual and auditory-visual modes only, the reading group showed a significant difference with $p = .0461$.

Across groups the auditory-visual mode yielded the highest percentage of correct responses while the auditory mode yielded the lowest.

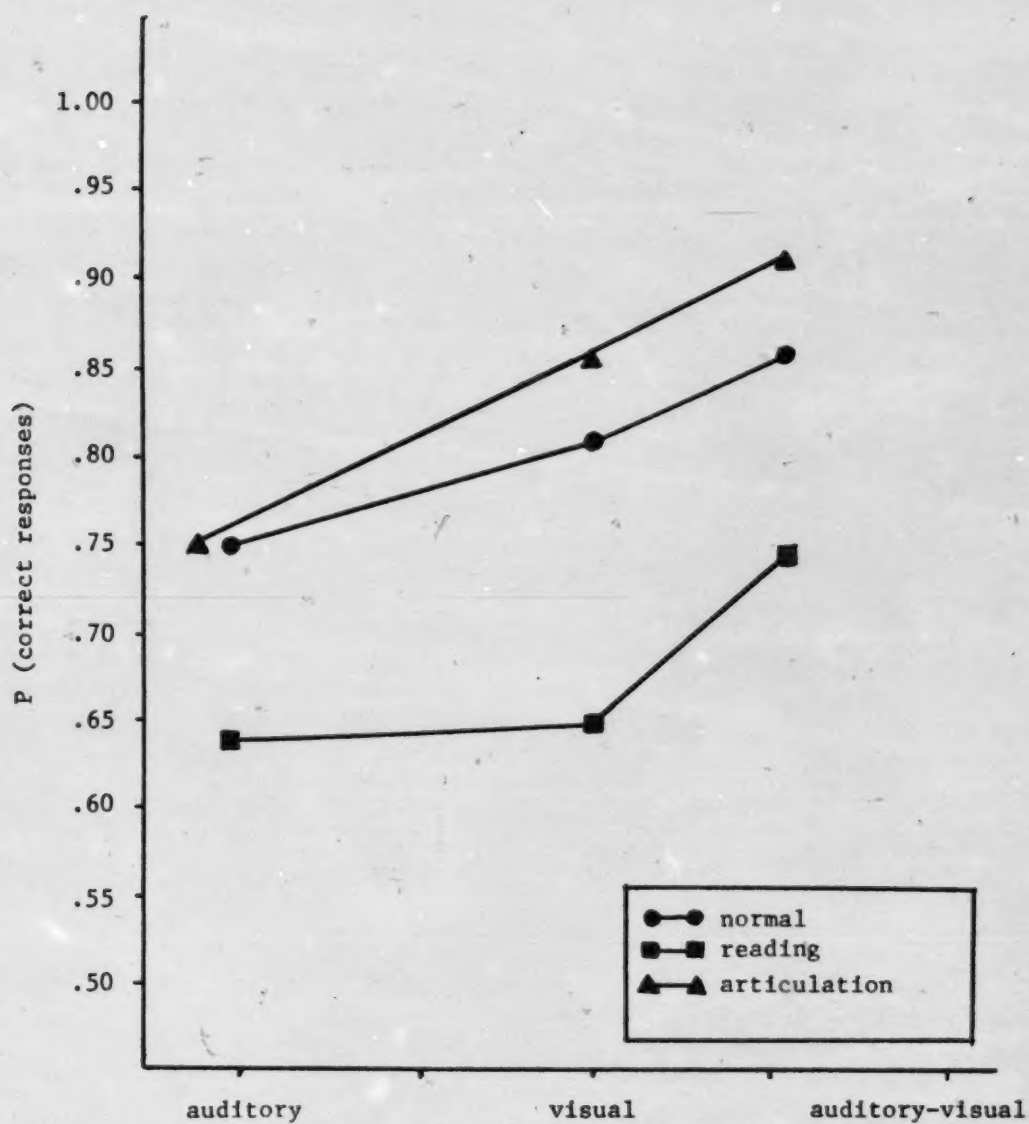


Figure 2. Effect of Mode of Presentation X Group

Qualitative Analysis

Errors in the experiment basically fell into two categories--perceptual errors and blending errors. Perceptual errors were those errors which indicated perceptual confusions or failure to make the correct letter to sound correspondence. Blending errors were simply errors resulting from failure to understand the task itself.

The five most common perceptual errors found in all groups were /ʃ/ for /tʃ/ across all modes, /n/ for /m/ in the auditory mode, and /b/ for /d/, /s/ for /ʃ/, and /d / for /g/ in the visual mode. This type of error accounted for 63% of the entire errors--24% of these errors occurring in the articulation group, 29% in the normal group, and 48% in the reading group. Across groups perceptual errors accounted for 38% of the errors in the auditory mode, 36% in the visual mode, and 26% in the auditory-visual mode.

As might be expected in the auditory mode the greatest consonant confusion resulted from those sounds which have overlapping auditory characteristics. Frequent vowel errors consisted for the most part of confusions between /ʌ / and /æ /--accounting for 48% of the vowel error. Other vowel errors also frequently observed were /a/ for /æ / and /ʌ/ for /I/.

In the visual mode the most frequent perceptual error was the confusion of "b" and "d". Use of the wrong phoneme-grapheme correspondence occurred most frequently with the vowels and "g", letters which in conventional orthography have more than one corresponding phoneme. While no apparent pattern of errors

occurred with the vowels; the error with "g" was always a substitution of /dʒ/.

In the auditory visual mode, errors were most frequent on the vowels while consonant confusion was reduced in comparison to the other modes. No pattern of vowel error was present.

Blending errors accounted for 37% of the total errors. For the most part these errors fell into five categories:

1. Failure to respond, perseverative, and anomalous responses.
2. Sequential errors, /Ib/ for /bI/.
3. Omissions of final consonants, /bI/ for /bIg/.
4. Additions, /sænd/ for /sæd/, /ItʃIn/ for /tʃIn/.
5. Addition of /ʌ/ to final plosives /rʌbʌ/, /bæɣʌ/.

The last error was overall the most frequent blending error yet it occurred exclusively in the auditory and auditory-visual mode. In the auditory mode this type of error accounted for 27% of the total blending error, and in the auditory-visual mode it accounted for 31%.

Regarding the total number of errors made within groups, the reading group produced approximately twice as many errors as the articulation group with 305 errors for the reading group and 150 for the articulation. In total errors the normal group fell only slightly above the articulation group with 196 total errors. The reading group throughout the experiment made consistently more of the same types of errors as the normal and articulation groups. In the reading group scores indicate an inproportionate number of

errors were made concerning /ʃ/ for tʃ/ substitution and blending errors such as an addition of /ʌ/ to a voiced stop and, in general, simply failure to understand the task.

Discussion

The main objective of this study was to determine the effect of reading and articulation defects upon variables believed to affect the ability to blend sounds together. Of these variables, modality and syllable type were found to have a significant effect while order of presentation and mode of presentation across syllable type were not.

The fact that order of presentation, whether according to mode, syllable type or individual stimuli, was nonsignificant indicates that no significant learning took place during the experiment. That is, each subject was at the onset as knowledgeable concerning the task as possible and the sequence of presentation had no significant effect on how well the subject performed on any item.

In considering mode of presentation across syllable type and its effect upon performance, there seems to be no indication that a subject performed significantly better on a particular syllable type because of the mode in which it was presented. This indicates that overall within subjects there was a consistent level of performance on syllable type across modes.

In accordance with Holloway's (1975) findings, the two-phoneme sound segment (CV-C) was found to be easier to blend than those with a one-phoneme sound segment (V-C, C-V-C). Also in agreement with her findings, there was no significant difference in performance between the V-C and C-V-C syllable types although the performance on C-V-Cs was slightly poorer. Possible explanations

for these differences can be found in Holloway's (1975) discussion. In further comparing syllable types across groups, the greatest difference lies between the normal and reading groups with a significant difference on all syllable types. On the other hand, comparisons between normal and articulation groups yielded a significant difference in favor of the articulation group only on the C-V-C syllable type. This would seem to point to performance on syllable types as a greater indicator of reading difficulties than articulation defects.

When comparing modality across groups, results again bore out the findings of Holloway (1975) with performance being best for the auditory-visual and poorest for the auditory presentation. No significant differences were found between the normal and articulation groups in any mode, while comparisons between the normal and reading groups showed both the visual and auditory modes to be significantly different. Hence the auditory mode appeared to be equally difficult for all groups, while results in the visual and auditory-visual mode seem to indicate differences in blending abilities in the reading group.

In comparisons between modes within groups there appeared to be clear cut differences in performance between the auditory and auditory-visual mode in all groups; while comparisons between the auditory and visual modes, and the visual and auditory-visual modes showed no overall trend. It is interesting to note, however, that while confusions between the auditory and visual modes in the

reading group showed no significant differences, comparisons between the visual and auditory-visual modes did show a significant increase in performance. This seems to support the idea that retarded readers may benefit more from some type of multisensory approach rather than use of only one sensory modality.

In terms of specific errors it appears that the reading group simply made more of the same kinds of errors as the normal and articulation group. The fact that in comparison the reading group made more errors, specifically blending errors, indicates a lesser understanding of the blending task in general. And in following the same pattern of errors as the normal and articulation groups, it appears that the inability to blend sounds lies in some general deficit that is not particular to mode of presentation, syllable type, or type of error.

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APPENDIX A

STIMULUS LIST

STIMULUS LIST

	<u>Visual</u>	<u>Auditory</u>
<u>VCs</u>	1. us	/ʌs/*
	2. ad	/æd/*
	3. ig	/Ig/
	4. am	/æm/*
	5. ush	/ʌʃ/*
	6. un	/ʌn/
	7. ich	/Itʃ/*
	8. ach	/ætʃ/
	9. Ib	/Ib/
<u>C-V-Cs</u>	10. sad	/sæd/
	11. lid	/lId/
	12. jam	/dʒæm/
	13. chin	/tʃIn/
	14. rich	/rItʃ/
	15. bus	/bʌs/
	16. mash	/mæʃ/
	17. dug	/dʌg/
	18. gum	/gʌm/
<u>CV-Cs</u>	19. man	/mæn/
	20. bag	/bæg/
	21. lad	/læd/
	22. rub	/rʌb/
	23. sun	/sʌn/
	24. rush	/rʌʃ/
	25. big	/bIg/
	26. rim	/rIm/
	27. dish	/dIʃ/

*Indicates sense syllable

APPENDIX B

THE RELATIONSHIP AMONG SYLLABLE TYPE,
GROUP, AND MODE OF PRESENTATION

Table 1
Syllable Type X Group

Syllable Type	Normal	Reading	Articulation
V-C vs. C-V-C	**	NS	NS
V-C vs. CV-C	NS	NS	NS
C-V-C vs. CV-C	**	**	NS

** = $p < .01$

NS = not significant

Table 2
Group X Syllable Type

Group	V-C	C-V-C	CV-C
Normal vs. Reading	*	*	*
Normal vs. Articulation	NS	*	NS

* = $p < .05$

NS = not significant

Table 3

Mode of Presentation X Group

Group	Normal	Reading	Articulation
Auditory vs. Visual	NS	NS	*
Auditory vs. Auditory-Visual	*	*	**
Visual vs. Auditory-Visual	NS	*	NS

* = $p < .05$ ** = $p < .01$

NS = not significant

Table 4

Group X Mode of Presentation

Group	Auditory	Visual	Auditory-Visual
Normal vs. Reading	NS	**	*
Normal vs. Articulation	NS	NS	NS

* = $p < .05$ ** = $p < .01$

NS = not significant